

# Intelligent Energy in agricultural Farms

Shifting loads of a dairy farm by using photovoltaic power plants in combination with an ice-storage-system

Felix Künkel B.Eng., Tobias Rehm B.Eng., Patrick Beuel M.Sc., Dipl.-Ing. Thomas Mockenhaupt and Prof. Dr. Christiane Rieker

Technische Hochschule Köln

## About the project - Introduction

Analyse the consumption of agricultural farms with smart meter measuring systems to define potentials for load shifting and energy savings.

Project partners are:

- TH-Köln
- NaRoTec e.V. [1]
- Maschinenring Höxter-Warburg [2]
- Landwirtschaftskammer NRW (department of agriculture State of NRW) [3]

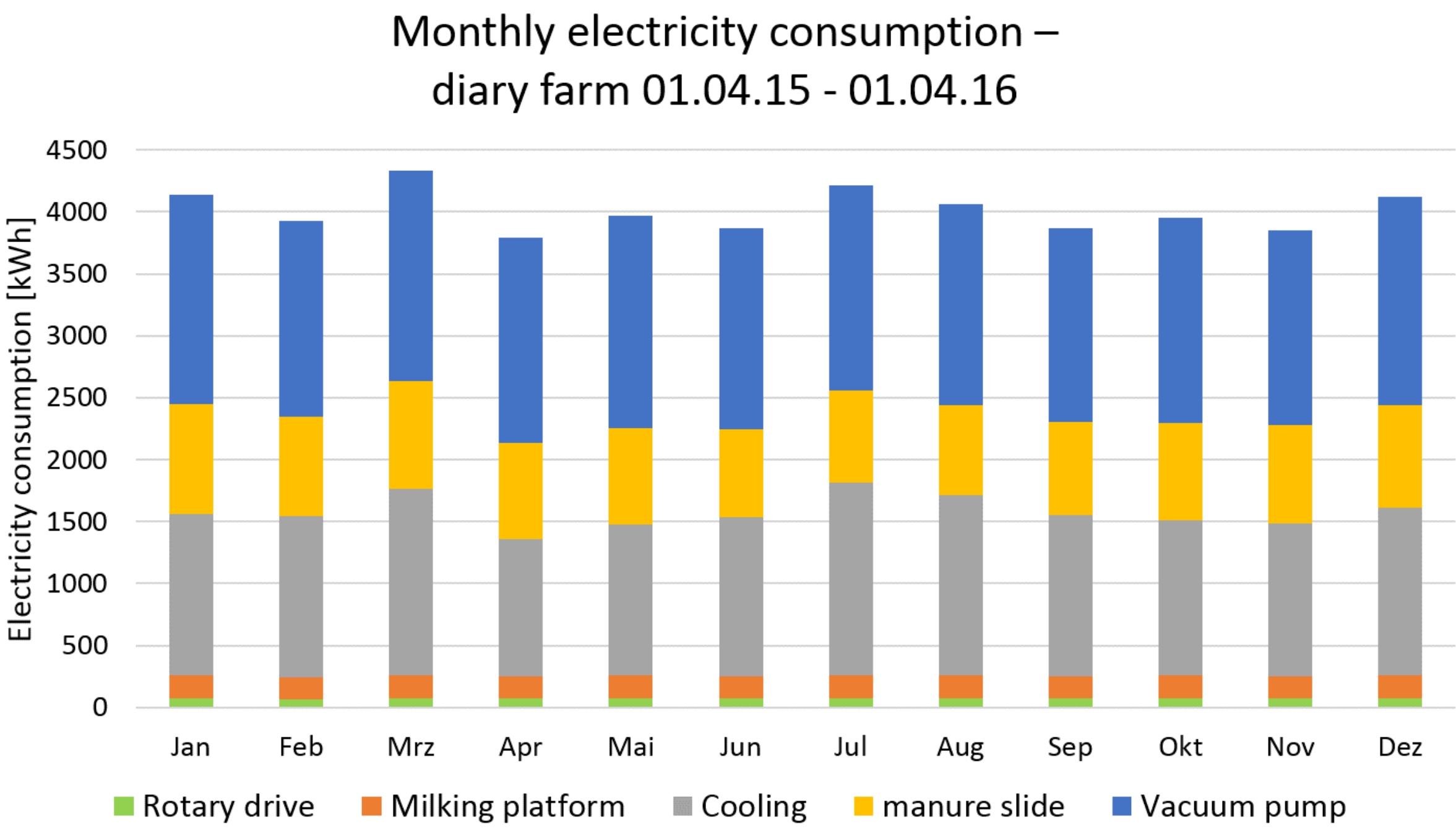
The project is funded by department of environment protection of the state NRW in Germany [4].

Ministerium für Klimaschutz, Umwelt,  
Landwirtschaft, Natur- und Verbraucherschutz  
des Landes Nordrhein-Westfalen  
Funding code: 17-02.04.01-18/13



## Our approach

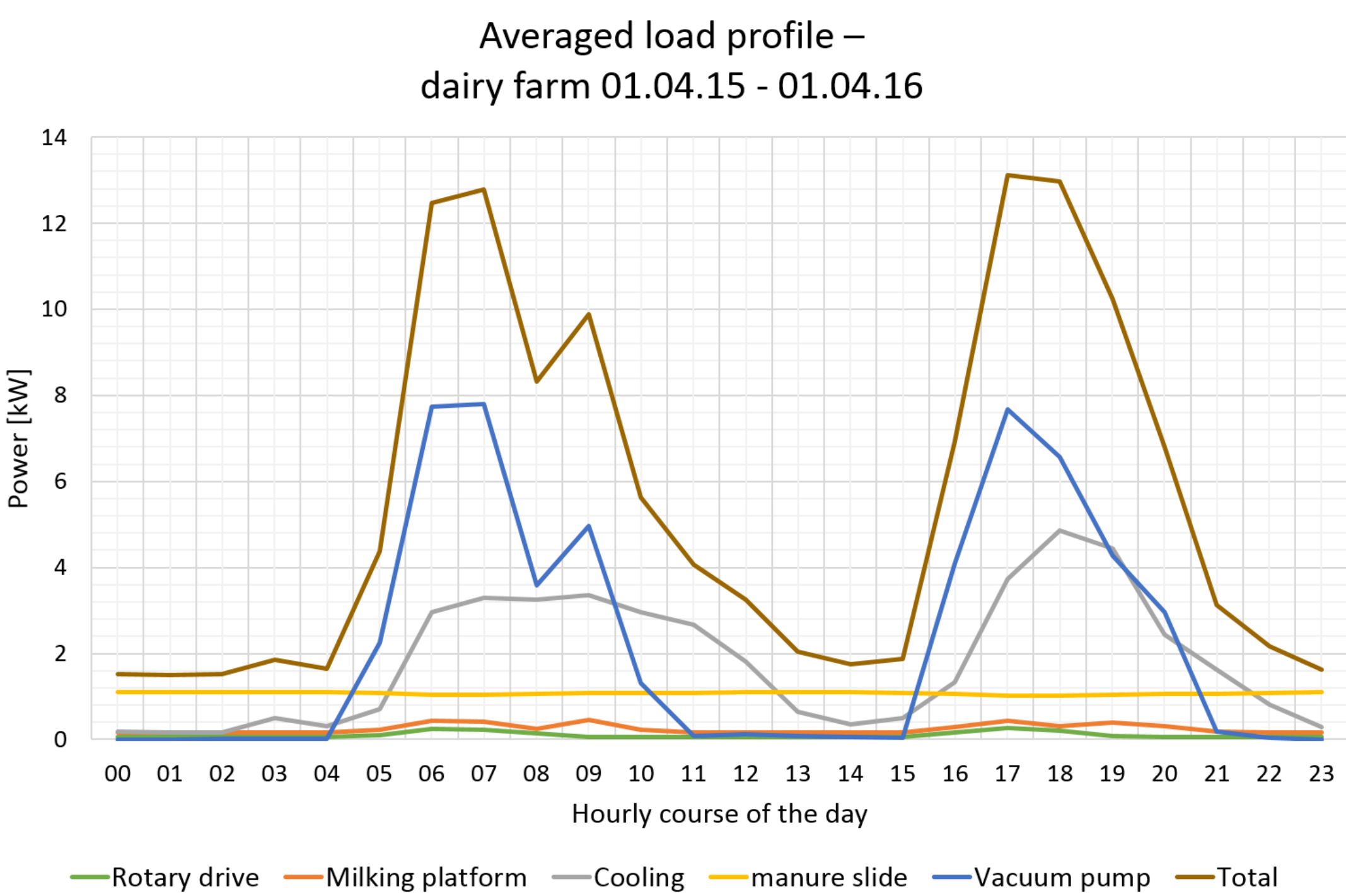
1. Choose an agriculture farm with the most reliable data of the energy consumption from the smart meter measuring data
2. Analyse the smart metering data
3. Create a load profile



## Daily load profile

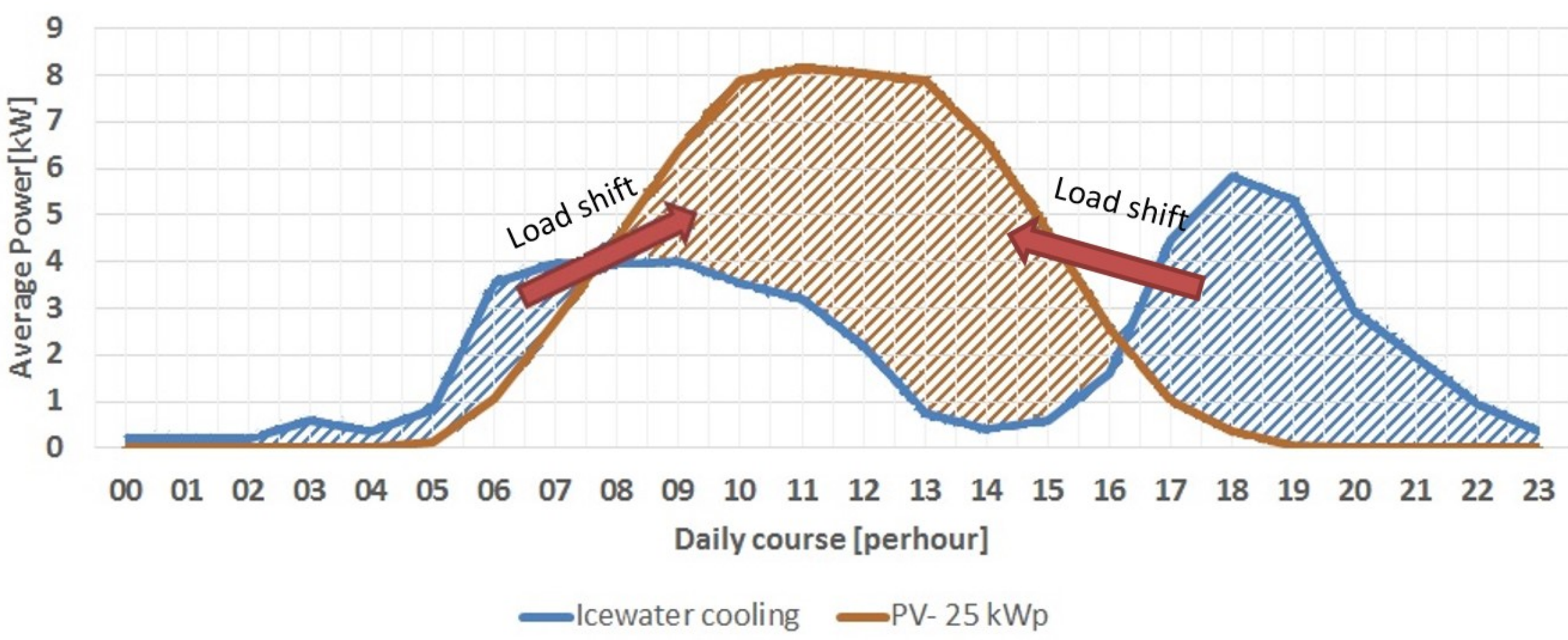
Identify daily load profiles peaks

Locate shiftable loads -> highest shifting potential is the cooling component



Source: [www.packocooling.com](http://www.packocooling.com)

Average daily load course PV - icewater cooling  
01.04.15-01.04.16

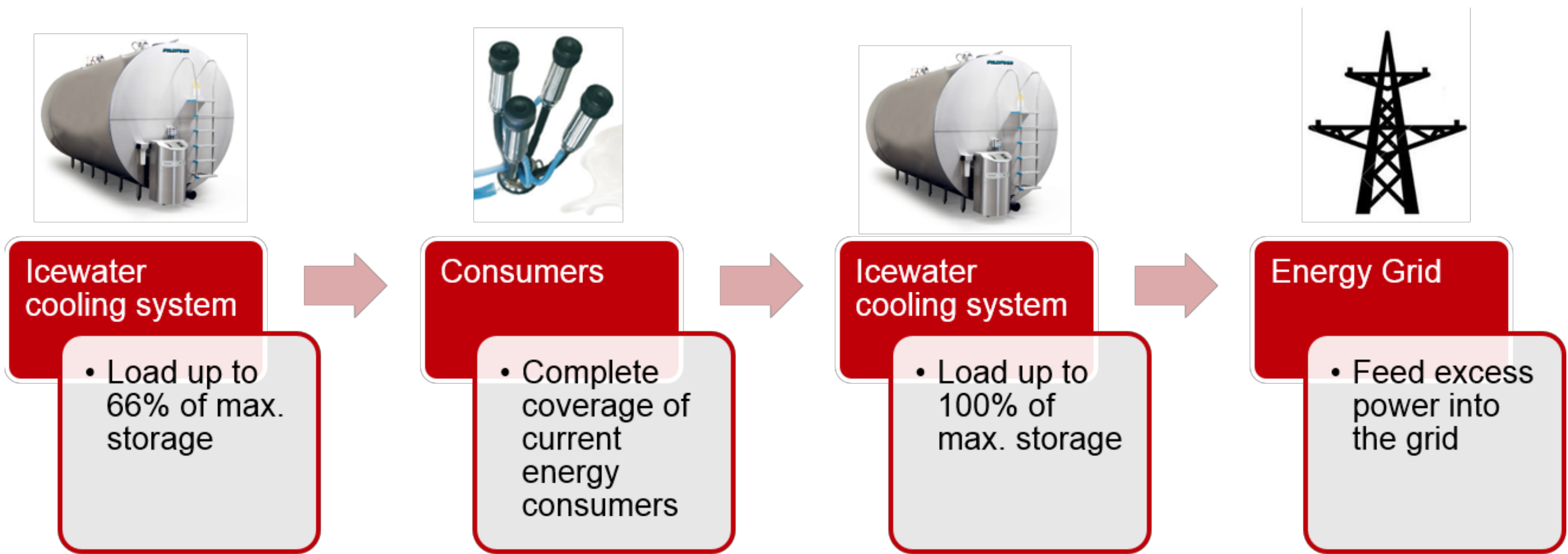


## Photovoltaic-Simulation and parameters

Boundary conditions for simulation with “PV-SOL” (PV planning program):

- Different sizes of simulated power plants according to cover different energy consumers (Cooling system coverage always 100%)
- Total load profile of the farm is a combination of measured load profile and standard load profiles for missing components

Priority order to optimize degree of self-sufficiency:



## Conclusion and remaining work

### Results so far:

PV-System	Direct cooling - Consumption share [%]	Direct cooling - Degree of self-sufficiency	Ice-water cooling - Consumption share [%]	Ice-water cooling - degree of self-sufficiency
25 kWp	52,07	18,15	66,43	22,08
50 kWp	35,96	25,07	45,9	30,50
250 kWp	11,27	39,29	13,87	46,09

Ice-water-cooling in combination with the photovoltaic-system can increase the self-sufficiency by up to 7 %

### Remaining workload:

- Optimize size of photovoltaic power plant
- Verify results
- Profitability analysis



Contact: Patrick Beuel, M.Sc. CIRE - Cologne Institute for Renewable Energy Technische Hochschule Köln Betzdorfer Straße 2, 50679 Köln – Germany Tel.: +49 221 8275 2415 Mail: [patrick.beuel@th-koeln.de](mailto:patrick.beuel@th-koeln.de)